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New records of corticolous myxomycetes from Turkey

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Abstract– Eight myxomycete species from the Marmara region are newly recorded for Turkey: *Amaurochaete tubulina, Comatricha longipila, Diderma cinereum, D. umbilicatum, Didymium lenticulare, Physarum serpula, Stemonitis inconspicua,* and *Symphytocarpus confluens.*

Keywords– *Quercus* bark, moist chamber technique

Introduction

The Marmara region of Turkey is located in the Euro-Siberian and the Mediterranean phytogeographical regions of Turkey. The western part of the region is subjected to Mediterranean climate and is covered with pine forests and shrubs, whereas the eastern and northern parts have a continental climate and are rich in oak forests (Atalay 2002).

Turkey is an important world distribution area for *Quercus* diversity (Günal 1997). There are 18 species of oak trees in Turkey (Seçmen et al. 1995), of which 11 occur in the Marmara region.

The first myxomycetes for Turkey were reported by Härkönen & Uotila (1983) and Härkönen (1987). Although the number of myxomycete species worldwide is about 1000 (Lado 2001), the reported numbers for Turkey are relatively low, around 232 (Sesli & Denchev 2014). With this paper we contribute further knowledge on the myxomycetes in the country by presenting eight species collected on bark of *Quercus* trees in the Marmara region, all new records for Turkey.

Materials & methods

Field excursions were carried out in a randomised manner during June and October of 2005–2008. All material was collected from the bark of *Quercus* species in different

provinces of Turkey's Marmara region. Myxomycete fructifications were obtained from moist chamber cultures in the laboratory as described in Stephenson & Stempen (1994). The cultures were moistened with distilled water and kept under diffuse sunlight within a temperature range of 22–25°C.

The cultures were examined under a dissecting microscope every day for a 4-week period. Whenever developing fructifications were found, the bark pieces on which they were found were removed from the Petri dish, allowed to dry slowly, and then placed in herbarium boxes. The same chambers were then rewetted for another 4-week period and examined as before. The specimens are stored in the authors' personal collections in the Department of Biology, Uludağ University, Bursa, Turkey. Species have been identified according to Castillo et al. (1997), Farr (1976, 1981), Ing (1999), Keller & Brooks (1977), Lado & Pando (1997), Martin & Alexopoulos (1969), Mitchell (2013), Nannenga-Bremekamp (1991), Stephenson & Stempen (1994), and Thind (1997). Nomenclature follows Lado (2001).

Species recorded

Amaurochaete tubulina (Alb. & Schwein) T. Macbr. PLATE 1

Sporocarps aethaliate. Aethalia pulvinate, somewhat depressed. Sporothecae covered by a thin, translucent cortex. Hypothallus thin, shining, prominent. Capillitium branched, irregularly sprouting out from the base, branching and anastomosing freely. Spore mass black. Spores pale olivaceous, 12–15 µm diam., finely warted.

SPECIMEN EXAMINED – **TURKEY**, **BILECIK/MERKEZ**; Karadere–Sütlük road, 40°05′35.3″N 29°49′51.9″E, alt. 977 m, on bark of *Quercus frainetto* in oak forest, 22.7.2007, Oran 303–1.

COMMENTS—*Amaurochaete* is a typical genus in the order *Stemonitales* characterized by a dendroid capillitium. Previously only a single species, *A. atra* (Alb. & Schwein.) Rostaf., has been reported from Turkey (Sesli & Denchev 2014). An examination of published records of *A. tubulina* indicates that this species is frequently isolated from conifer bark, whereas our specimen was recovered from *Quercus* bark in a moist chamber culture. Our specimen appears to represent the first aethaliate structure of an *Amaurochaete* obtained from a moist chamber culture.

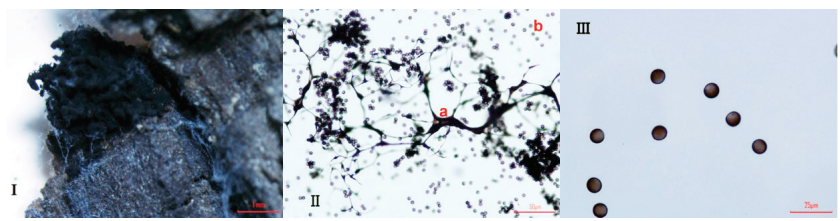

PLATE 1. *Amaurochaete tubulina*. I– aethalium; II– a. capillitium, b. spores; III– spores.

Amaurochaete tubulina somewhat resembles *A. atra* and *A. comata* G. Lister & Brândză. It differs from *A. atra,* which is clearly distinguished by an early fugacious aethelial wall, in its capillitial structure that widens in the axils and is connected to the columella but not connected to neighbouring sporangia. *Amaurochaete tubulina* is distinguished from *A. comata* by its sparsely anastomosing free ends, spiny capillitia, and spores that are less strongly warted on one side.

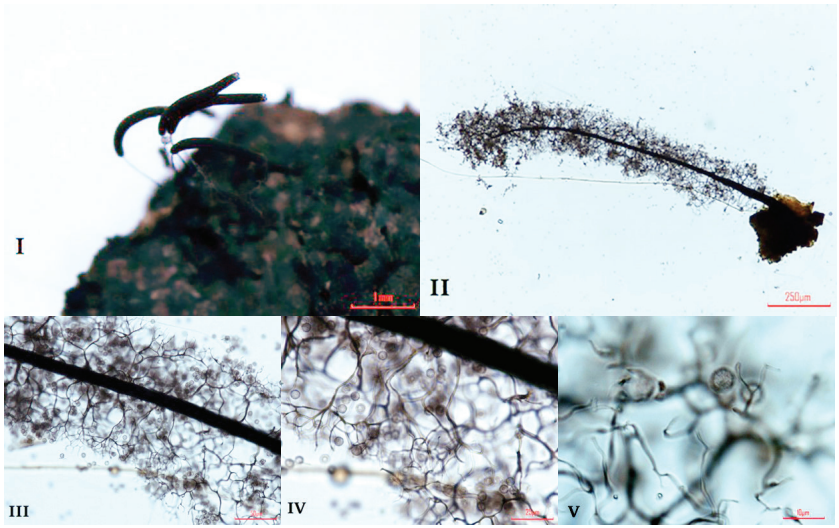

Plate 2. *Comatricha longipila*. I– sporocarps; II– a. hypothallus; b. columella; III– a. columella; b. capillitium; c. spinose capillitial ends; IV– a. columella, b. capillitium, c. spore; d. capillitial ends; V– a. capillitium, b. reticulate spores.

Comatricha longipila Nann.-Bremek. Plate 2

Sporocarps in small groups or solitary, 1.5–2.0 mm tall, nearly erect. Hypothallus discoid or continuous under the group, brown and inconspicuous. Stalk up to 33% of the total height, with a net of fibres at the base, often opaque above. Sporotheca cylindrical or obovoid, 0.3–0.6 mm diam., brown. Peridium usually completely fugacious but sometimes persistent as a collar around the stalk apex. Columella merging into the capillitium just below the apex of the sporotheca. Capillitium primary branches perpendicular to the columella, hardly anastamosing, dichotomously branched with many, rather straight, long, free ends at the periphery which are sometimes slightly swollen. Spores pale red-brown, 6.0–7.0 µm diam., finely warted.

Specimen examined – **TURKEY**, **Kirklareli/Merkez**; Üsküp–Beypınarı road 2 km, 41°45′05.7″N 27°26′32.4″E, alt. 403 m, on bark of a solitary *Quercus pubescens* tree in agricultural land, 15.6.2006, Oran 91–2.

Comments—Our specimen, as was the case for the type specimen, appeared in a moist chamber culture prepared with a bark sample from *Quercus*. The peridium occasionally remains as a permanent collar around the stalk. As noted by Nannenga-Bremekamp (1991), "*C. longipila* is characterized by the lax internal capillitium, with long free ends at the periphery and its small spores." However, Ing (1999) indicated that its small spores, lack of an outer capillitial network, and long free ends separate *Comatrica longipila* from small specimens of *C. laxa* Rostaf.

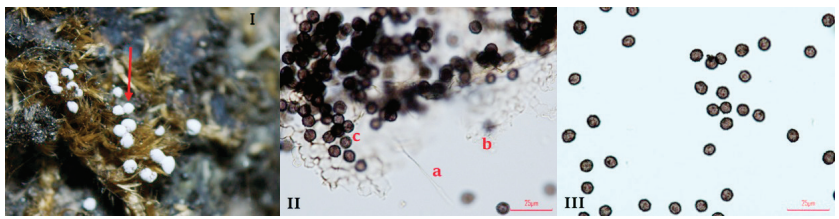

Plate 3. *Diderma cinereum*. I– individual sporocarps;
II– a. capillitium, b. peridium, c. spores; III– verruculose spores.

Diderma cinereum Morgan Plate3

Sporocarps sessile, gregarious, subglobose, somewhat depressed, 0.3–0.5 mm diam., pearl-grey. Hypothallus inconspicuous. Peridium single, thin, smooth, crustose. Capillitium of slender, dark threads, sparsely branched, easily detached from the columella. Spore-mass black. Spores dark violet-grey, 9–11 µm diam., verruculose.

Specimen examined – **TURKEY**, **Balikesir/Merkez**; Konakpınar–Söpköy road 5 km, 39°25′00.8″N 27°50′06.5″E, alt. 331 m, on bark of *Quercus cerris*, 28.7.2006, Oran 242–2.

Comments—There are various reports of the presence of a single or double peridium in this species, but our specimen clearly has a single peridium. Ing (1999) observed that *D. cinereum* is similar to *D. spumarioides* (Fr.) Fr. but differs in having a single peridium, deciduous capillitium, and dark grey spores.

Diderma umbilicatum Pers. Plate 4

Sporocarps short-stalked or sessile, pearl-grey. Peridium double, the outer layer calcareous or occasionally limeless, adhering closely to the membranous inner layer. Dehiscence irregular, leaving a ragged cup which shows white on the inside. Columella prominent, pale, subglobose, smooth or rugose. Stalk stout, reddish-brown, covered with white lime. Spores dark brown in mass, purple brown in transmitted light, densely verruculose, 10–12 µm diam.

Specimens examined – **TURKEY**, **Çanakkale/Yenice**; around Gönen dam, 39°57′41.1″N 27°25′52.2″E, alt. 191 m, on bark of *Quercus cerris* in composite forest,

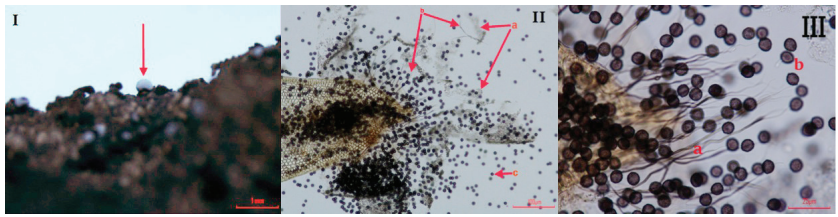

Plate 4. *Diderma umbilicatum*. I– individual sporocarp;
II– a. peridial fragments, b. capillitium, c. spores; III– a. capillitium, b. spores.

29.7.2006, Oran 253–1; **Sakarya/Geyve**; Bozcağız–Koru road, 4 km to Koru village, 40°31′33″N 30°26′49″E, alt. 350 m, on bark of *Quercus virgiliana* in oak–beech forest, 7.10.2007, Oran 266–1.

Comments—*Diderma umbilicatum* is included in *Diderma* subg. *Leangium* (Link) Macbr. and has often been considered a variety of *D. radiatum* (L.) Morgan (Nannenga-Bremekamp 1991). Ing (1999) suggested that *D. umbilicatum* resembles both *D. montanum* (Meyl.) Meyl. and *D. radiatum*, especially with respect to peridial characteristics. Hence, it was considered to be synonymous with *D. radiatum* until quite recently. However, it is actually quite different, having a number of features (e.g., irregular dehiscence, non-cartilaginous peridium, pale columella, stout stalk) that are not present in *D. radiatum*. Under a hand lens, it may resemble *D. montanum*, from which it can be distinguished by its thicker and reddish short stalk, large columella, and usually larger spores. Ing (1999) noted that its large pale sporangia, conspicuous pale columella, and thick stalk easily separate *D. umbilicatum* from other *Diderma* taxa.

Didymium lenticulare K.S. Thind & T.N. Lakh. Plate 5

Sporocarps stipitate, up to 2 mm tall, scattered to loosely gregarious. Hypothallus dark brown, rotate. Stalk 1–1.8 mm long, erect, grooved, tapered, dark brown below, lighter and translucent above, scantily charged with lime crystals, particularly at the base. Sporotheca erect or nodding, strongly discoid, deeply umbilicate at the base, white, 0.5–0.8 mm diam. Peridium membranous, hyaline, densely covered with lime deposits which form very irregular ridges and plates. Columella absent. Capillitium of stout, subhyaline threads, sparingly branched and anastomosed and with bead-like thickenings. Spore-mass black. Spores deep violaceous brown by transmitted light, globose, distinctly verrucose, also marked by conspicuous clusters of darker and bigger warts, 9–11 μm diam.

Specimen examined – **TURKEY**, **Kirklareli/Pinarhisar**; Çayırdere–Akören road 2 km, 41°42′19.3″N 27°31′15.7″E, alt. 269 m, on bark of *Quercus frainetto* in an oak stand, 25.7.2006, Oran 179–2.

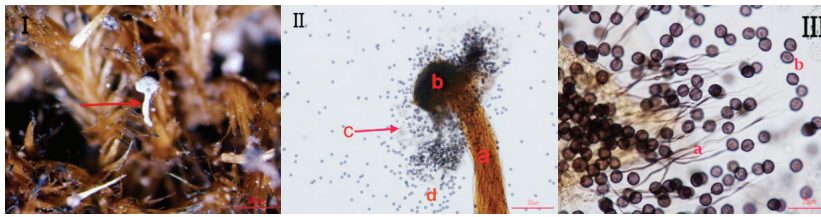

Plate 5. *Didymium lenticulare*. I– individual sporocarp;
II– a. stipe, b. pseudocolumella, c. capillitial threads; d. spores;
III– a. crusted lime, b. capillitium, c. spores.

Comments—*Didymium lenticulare* very closely resembles *D. clavus* (Alb. & Schwein.) Rabenh. but differs in a number of features, including its hyaline, crustose peridium with thick ridges, longer stipe, more dispersed lime crystals (especially in the lower region), lack of a columella, and spores that are larger, lighter in color, and distinctly verrucose (Thind 1977).

This species also resembles *D. squamulosum* (Alb. & Schwein.) Fr. in its possession of a hyaline peridium and similar spores but differs in its densely thick calcareous deposits on the peridium, strongly discoid sporotheca, and lack of a columella. In addition, its stipe is much longer and darker than that typically observed in *D. squamulosum*. The stipe of *D. lenticulare* is non-calcareous, although it is sprinkled with lime crystals.

The stipe also differs from that of *D. iridis* (Ditmar) Fr., which has strongly discoid sporangia that are deeply umbilicate below. The extraordinarily small lime crystals of *D. lenticulare* also serve to distinguish it from allied species (Thind 1977).

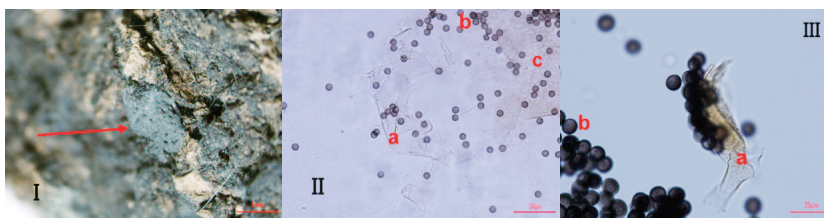

Plate 6. *Physarum serpula*. I– plasmodiocarp;
II– a. lime node, b. spores, c. peridium; III– a. lime node, b. spores.

Physarum serpula Morgan Plate 6

Plasmodiocarpous, forming lines, rings, or a simple network, 0.2–0.4 mm wide, sometimes fusing laterally to form a broad fruiting surface, often interspersed with globose sporocarps, dull yellow or ochraceous, sessile. Hypothallus diffuse. Peridium single, thin, of closely encrusted lime globules,

without calcareous scales, fragile, membranous, persistent. Capillitium dense, calcareous, the nodes numerous, large, angular, branching, pale yellow or whitish, connected by short, hyaline threads or broad limy strands and then almost badhamioid. Spore-mass dull black. Spores dark brown, verruculose, with a paler and smoother area on one side, 10–13 µm diam.

Specimen examined – **TURKEY**, **Bursa/Nilüfer**; around Alaaddinbey village, 40°12′10.7″N 28°53′45.2″E, alt. 78 m, on bark of a solitary *Quercus robur* tree in agricultural land, 16.9.2007, Oran 312–2.

Comments—*Physarum serpula* was treated by Ing (1999) as part of a trio with *P. auriscalpium* Cooke and *P. decipiens* M.A. Curtis, and Martin & Alexopoulos (1969) observed that these three morphologically similar species were often confused with one another. *Physarum serpula* is frequently confused with *P. auriscalpium,* which differs by having a peridium dotted with prominent glossy lime scales rather than the peridium evenly impregnated with lime in *P. serpula.* Ing (1999) observed that *P. decipiens,* which is more sporangiate than *P. auriscalpium* or *P. serpula,* has a more badhamioid capillitium.

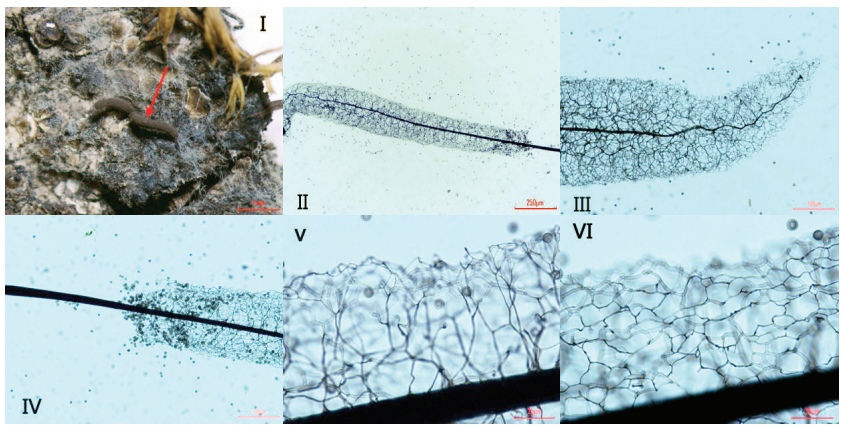

Plate 7. *Stemonitis inconspicua.* I) sporocarps; II– individual sporocarp; III– apical end of sporotheca; IV– basal end of sporotheca; V– inner net of capillitium; VI– surface net.

Stemonitis inconspicua Nann.-Bremek. Plate 7

Sporocarps clustered on a common hypothallus, sometimes gregarious, total height 2–8 mm. Hypothallus thin, silvery, red-brown by light microscope. Stalk approximately 0.5 mm long, thin, black, opaque, shining. Sporothecae brown, blunt cylindrical, 1.5–2.5 mm tall. Peridium fugacious, except sometimes at the base, where red-brown fragments show a structure similar to that of the spores. Columella tapered, dissipating just below the apex. Capillitium forming approximately 3 meshes on the radius, consisting of slender threads variously

widened at the junctions, becoming extremely fine towards the periphery, the surface net slender, irregular, fragmentary, with spiny free ends, dissipating towards the apex. Spore mass dark brown. Spores pale red-brown, prominently banded-reticulate with 2–3 meshes across the hemisphere, 8–9 µm diam. excluding the bands, which form a border approximately 0.5 µm high in optical section.

Specimens examined – **TURKEY**, **Bilecik/Merkez**; Karadere–Sütlük road, 3 km to Sütlük, 40°05′35.3″N 29°49′51.9″E, alt. 977 m, on bark of *Quercus frainetto* in an oak stand, 22.7.2007, Oran 3–1; **Çanakkale/Merkez**; Çan–Çanakkale road, Kocalar turnout, 40°02′03.7″N 26°46′57.1″E, alt. 469 m, on bark of *Quercus frainetto* in an oak stand, 6.7.2005, Oran 303–4.

Comments—*Stemonitis inconspicua* can be distinguished from the similar *S. foliicola* Ing by its small size and banded-reticulate spores (Ing 1999).

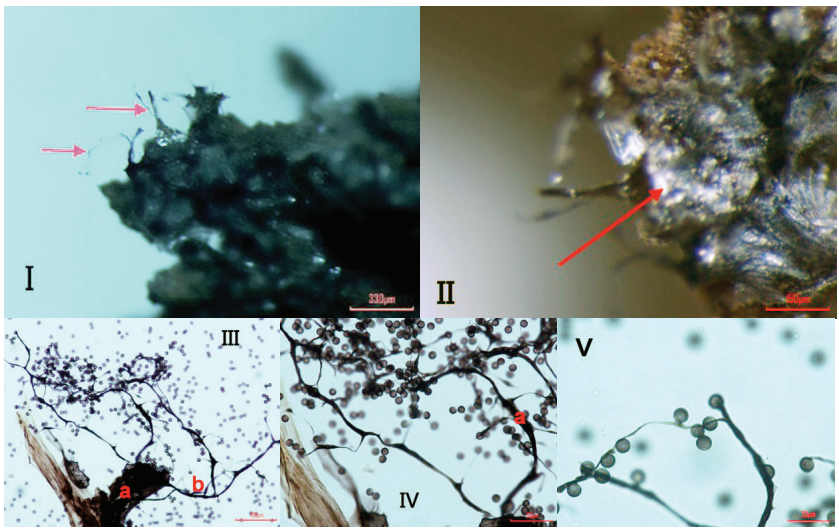

Plate 8. *Symphytocarpus confluens*. I– pseudoaethalium; II– silver coloured hypothallus; III– a. hypothallus and stipe, b. capillitium; IV– a. enlargements on capillitium, b. spores; V) spores.

Symphytocarpus confluens (Cooke & Ellis) Ing & Nann.-Bremek. Plate 8

Pseudoaethalium 2–3 mm tall and 0.5–4 cm diam., deep black. Sporothecae approximately 0.5 mm diam. Hypothallus silvery. Peridium fugacious except for a number of more or less rounded plates, smooth and connected to the capillitium. Columella absent or, if present, opaque, dissipating below the apex. Capillitium a wide-meshed reticulum of thick, dark purple threads with small axillary membranes, looped at the periphery. Spores dark purple-brown in transmitted light, (10–)11–13 µm diam., distinctly warted.

Specimen examined – **TURKEY, Kirklareli/Merkez**; Dereköy–Kula road, around Geçitağzı village, 41°57′34.9″N 27°21′43.4″E, alt. 624 m, on bark of *Quercus petraea*, 16.6.2006, Oran 110–1.

Comments—*Symphytocarpus confluens,* which is close to *S. impexus* Ing & Nann.-Bremek, differs in its shorter, more elongated, deep black sporangia, which occasionally possess an opaque columella that dissipates below the apex of the sporangium (although it is not uncommon for the columella to be absent). Hence, the sporangia of *S. confluens* are much deeper black in color and have much larger spores that are at least 10 (usually ≥12) µm in diameter (Nannenga-Bremekamp 1991).

Discussion

Bark from *Quercus* trees sampled from 11 cities and six provinces in the Marmara region were the source of our new records for Turkey: Balikesir province (*Diderma cinereum*), Bilecik province (*Amaurochaete tubulina, S. inconspicua*), Çanakkale province (*D. umbilicatum, S. inconspicua*), Bursa province, (*P. serpula*), Kırklareli province (*C. longipila, D. lenticulare, S. confluens*), and Sakarya province (*D. umbilicatum*). As the distribution shows, two species (*Didymium umbilicatum, Stemonitis inconspicua*) were recovered from two different provinces.

The character of the tree bark structure is an important factor for myxomycete distribution and productivity. Härkönen et al. (2004) concluded that a smooth basic bark has a low water holding capacity and does not support a high diversity of myxomycetes, bryophytes, and lichens. McHugh (1998) noted that individual *Quercus* species and *Quercus* forests are the most productive sources for myxomycetes. Bark from oak trees offers a suitable structure for sheltering myxomycete spores. Stephenson (1989) noted that the considerable variation in bark structure offers good potential microhabitats for corticolous myxomycetes. High water holding capacities may benefit corticolous myxomycetes directly as their active plasmodia are highly dependent on the availability of liquid water.

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